

## COMPARISON OF BANKRUPTCY AND SUSTAINABILITY PREDICTION: ALTMAN Z SCORE VERSUS GROVER MODEL

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**Abstract:** This study aims to prove whether the Altman Z-Score and Grover models can predict bankruptcy and whether there are differences in scores between the two models. Besides, it aims to identify which prediction model is the most accurate in predicting bankruptcy and sustainability in retail companies. This research was conducted by taking a sample of financial statement data of 57 on the Indonesia Stock Exchange (BEI) in 2016-2018 which were divided into two groups: 27 financial statement data that went bankrupt (Financial Distress) and 30 financial statement data that are still ongoing (Non-Financial Distress), with a total sample of financial statement data of 57. The data collection method uses the purposive sampling method and the data is analysed using logistic regression and paired sample t-test. The accuracy of the prediction model is analysed utilising the SPSS software with the condition that the data must be normally distributed. The result shows that the Altman Z-Score and Grover models can be used to predict bankruptcy. This shows that the financial ratios used in the Altman Z-Score and Grover models can describe the condition of bankruptcy. The results of this study also show that there are differences in scores between the Altman Z-Score model and Grover in predicting bankruptcy, and the Altman Z-Score Model is the most suitable bankruptcy prediction model applied to retail companies listed on the Indonesia Stock Exchange with an accuracy rate of 60%.

**Keywords:** Comparison, Bankruptcy, Sustainability, Altman Z-Score, Grover, Indonesia

### 1. Introduction

The importance of financial accounting for all companies is that it provides data for financial decisions. Financial managers must be able to develop their business analysis and problem-solving skills (Mattimoe, 2008; Scapens, 2006; Burns and Balvinsdottir, 2005), without limiting their duties in verifying accounting data. The picture of financial prosperity and resilience that are reflected by each company is influenced by investors, creditors, and stakeholders (Ryu and Jang, 2004; Lazaridis and Papadopoulos, 2002). Many studies on financial analysis conducted at the international level are related to forecasting economic failures in companies (Vranas, 1991). Financial ownership and management are considered important for all companies, regardless of size, not only for the success of business activities but especially as an important condition for survival (DeFranco and Schmidgall, 1998). Many studies indicate that companies in various sectors have emphasised the

importance of cash flow (DeFranco and Schmidgall, 1998; Mills and Yamamura, 1998; Epstein and Pava, 1994; Sylvestre and Urbancic, 1994; Schmidgall, et al., 1993; Bohannon and Edwards, 1993; Casey and Bartczak, 1985), to the extent that it is used to determine the difference between a company's success and bankruptcy (Beck, 1994). If the company is unable to strengthen its condition and performance properly, something bad will happen to the company in the future. Financial difficulties and even bankruptcy are bad possibilities that occur in the future, that every company must be prepared to face. In the face of uncertainty in the future, companies need an assessment of their performance. The assessment aims to anticipate the possibility of a bad condition in the future while finding solutions to prevent it from the beginning.

Bankruptcy is a condition of a company that fails to obtain profits from its operational activities continuously. Bankruptcy can be interpreted as a failure, both economic failure, and financial failure. Economic failure occurs due to unbalanced income and expenses, where the company's income is smaller than its expenditure. While financial failures occur because obligations that are due cannot be fulfilled by the company. The ability to predict bankruptcy may be important for financial users, but it is also important for groups such as investors, creditors, stakeholders, credit rating agencies, auditors, and regulators (Lifschutz and Jacobi, 2010). Predicting bankruptcy is always important for a company to conduct, however, it is considered very important during a time of financial and economic crisis. Early indications of a bankrupt company did not just appear, but it can be observed and measured through financial statements if analysed more closely. Financial statements can provide information to companies about performance, changes, and financial position that is useful for making a decision. Predicting the bankruptcy of a company can be done with discriminant analysis, where the company's financial statements for two or up to five years are analysed before the company is predicted to experience bankruptcy which is then converted into financial ratios. Bankruptcy can be caused by poor management, inaccurate sales estimates, inexperienced company management, rapidly changing technological advances, changes in preferences, and also the company's inability to follow as a leader in the changes that take place (Bărbuță-Mișu, N., & Madaleno, M, 2020).

Retail companies in Indonesia are currently sluggish due to the presence of sales through e-commerce or online that began to cause competition. The flood of sales through e-commerce has made the owners of retail outlets chaotic. This concern is reasonable because the prices and products offered in e-commerce are very competitive compared to prices in retail outlets, especially when the ease and development of technology cause consumers to be more comfortable transacting online. The facts in the field illustrate that retail companies are starting to struggle to maintain their survival. This situation can be observed clearly from the dismissal of employees and the closure of several retail outlets in strategic locations conducted by retail companies. The discontinuation and closure of several outlets by the company are unavoidable because it has a financial burden that is too large to survive. Therefore, competitive advantages in terms of both products and services must be observed by the company to be able to compete and stay on its business path.

Some studies are considered capable of predicting the financial situation of companies in the future, whether the company is included in the category of experiencing financial difficulties (bankruptcy), or company finances in a healthy condition (still ongoing). Many models can predict bankruptcy and among them, the Altman Z-Score is the most widely used model. Altman Z-Score describes companies that are experiencing bankruptcy, using the Working Capital to Total Assets (WCTA) ratio, Retained Earnings to Total Assets (RETA), Earning Before Interest and Tax to Total Assets (EBITTA), Book Value of Equity to Book Value of Total Liabilities (BVEBVTL), and Sales to Total Assets (SATA). It was developed by Jeffrey S. Grover in 1968 with the Grover model by producing three ratios namely Working Capital to Total Assets (WCTA), Earnings Before Interest and Taxes to Total Assets (EBITTA), and Return on Assets (ROA). Several previous studies have discussed the accuracy of bankruptcy predictions, including Barbara Gunawan, Rahadien Pamungkas, and Desi Susilawati (2017) who researched manufacturing companies, Trieste Avrilia Fanny and Endang Dwi Retnani (2017) on the plantation of sub-sector companies, and Dimas Priambodo (2017) who researched on mining sector companies. Differences in the results of previous studies occur because of differences in the characteristics possessed by each model. It seems that a certain type of company can be predicted exactly on one model but not on a different type of company. In the previous studies, research that examines bankruptcy predictions at retail companies is limited. Retail companies are companies that buy merchandise from suppliers and then sell it back to consumers to make a profit. At present, the retail sector is quite interesting to be the object of research because of the presence of sales through e-commerce or online that cause competition.

The purpose of conducting this research is to determine the comparison of bankruptcy predictions and sustainability in retail companies listed on the Indonesia Stock Exchange using two bankruptcy prediction models, namely Altman Z-Score and Grover. A comparison of the two models is expected to find the difference in scores between the two, as well as the model that has the best or accurate predictive quality. It is expected that this research will be able to contribute to help investors and other parties who have an interest in bankruptcy analysis so that they are accurate and the information can be used in making decisions better.

## 2. Literature Review

Agency theory proposed by Jensen and Meckling (1976) is used as the main theory that states agency relationships in which one or more principals employ other agents to perform several services in the company. Problems between principal and agent are influenced by several factors, including bad choices (Adverse Selection) and moral disaster (Moral Hazard). Adverse selection occurs when the principal does not know the agent's ability to carry out his duties, thus causing the wrong selection of agents. Moral Hazard occurs when a contract between the principal and agent has been approved, but the agent has more information about the company than the principal. Problems in the agency can also affect the company's performance that ends in the survival of the company. Financial managers must be able to develop their business analysis and problem-solving skills (Mattimoe, 2008) without limiting their

task in verifying accounting data. The picture of prosperity and financial resilience that is reflected by each company is influenced by investors, creditors, and stakeholders.

In addition to agency theory, this research is based on signal theory and is used to explain that financial statements are used to give positive signals (good news) and negative signals (bad news) to the wearer. The second theory that explains the importance of performance measurement is the signalling theory. Signal theory discusses how the signals of success or failure of management (agent) are conveyed to the owner (principal). Signal theory explains that giving signals is done by management to reduce asymmetric information. According to Sari and Zuhrotun (2006), signalling theory explains why companies have the drive to provide financial statement information to external parties so that the company has a good and credible relationship in the eyes of investors. Concerning management's performance, the relationship between the owner and management is very dependent on the owner's judgment who is in this case the investors.

## **2.2 Hypotheses Development**

### **2.2.1 Bankruptcy Prediction with the Altman Z-Score Model**

NYU Stern Finance Professor Edward Altman developed the Altman Z-score formula in 1967 and was published in 1968. In 2012, he released the latest version called Altman Z-score Plus which can be used to evaluate public and private companies, manufacturing companies, and non-manufacturing. One can use the Altman Z score to evaluate the credit risk of a company. Safitra (2013) in his research shows that there are two types of companies that can be categorised as in good health. For companies that are indicated to be vulnerable, they must increase their sales, revenue, and optimised operating costs, and as far as possible pay attention to the market value of equity. Kakauhe and Pontoh (2017) conducted a study on the accuracy of the Z-Score method in predicting the bankruptcy of manufacturing companies, the consumer goods sector where in general the company is indicated to be in good health because it has been experiencing an increase in sales as well as revenue. Besides, there has been an increase in total assets, both current, and fixed assets. Trieste Avrilia Fanny and Endang Dwi Retnani (2017) study on plantation sub-sector companies by using three models, namely Altman, Springate, and Zmijewski. They find out that the Altman and Springate models have similarities in predicting financial distress conditions because both Altman and Springate models use multi discriminant analysis (MDA) techniques. Concerning the prediction results of the Zmijewski model, it is much different from the Altman and the Springate model in that Altman can categorise data into two different groups of healthy companies and bankrupt companies. Besides, it can also reveal the benefits of both conditions if two groups are considered, and the analysis will determine the dimensions of the space to reduce the burden. From the description above, the first hypothesis is adopted, H1: The Altman Z-Score model can predict bankruptcy.

### 2.2.2 Bankruptcy Prediction with Grover Model

Barbara Gunawan, Rahadien Pamungkas, and Desi Susilawati (2017) utilise the three models namely Altman, Grover, and Zmijewski in studying manufacturing companies. They find that the Altman, Grover, and Zmijewski models are equally able to predict financial distress. In the findings state that the Grover model is the best in predicting financial distress and it is in line with Primasari's research (2017) on consumer goods industry companies. This shows that the financial ratios used in the three models can describe the financial distress condition of a company. The author indicates that the Grover model can be used by financial managers to evaluate company performance because the model incorporates a return on asset ratio that measures the net income of the year obtained from the use of assets. A higher return on assets indicates an improvement in corporate profitability. Based on the description above, the second hypothesis is adopted, H2: The Grover model can predict bankruptcy.

### 2.2.3 The difference in Score between the Altman Z-Score Model and Grover

Dimas Priambodo (2017) uses four models namely Altman, Springate, Grover, and Zmijewski in studying mining sector companies. The findings show that there are different scores in predicting financial distress between the Altman and the Grover model with a 95% confidence level. The different scores indicate that the scores of the five ratios namely working capital to total Assets (WCTA), Retained Earnings to Total Assets (RETA), Earning Before interest and tax to total assets (EBITTA), book value of equity to book value of total liabilities (BVEBVTL), and sales to total assets (SATA) are higher when compared to the Grover model development with three ratios namely working capital to total assets (WCTA), earnings before interest and taxes to total assets (EBITTA), and return on assets (ROA). Based on the research description above, the third hypothesis is adopted, H3: There is a difference in score in predicting bankruptcy between the Altman Z-Score model and the Grover model.

### 2.2.4 The Model with the Highest Accuracy

Hantono (2019) predicts financial distress using the Altman Z-score, Grover, and Zmijewski models in the large trading company sub-sector and shows that the Altman Z-score and Grover models have an accuracy rate of 100%. Dimas Priambodo (2017) conducted a study on mining sector companies and find out that the results of the Altman model of research yield an accuracy rate of 76.31% while the Grover model produces an accuracy rate of 78.94%. Besides, Enggar Prasetianingtias et al. (2019) study the agriculture sector companies and show an accuracy level of Altman Z-Score of 67.65% and Grover model of 85.29%. The results of Reza Prabowo's (2015) research in predicting the accuracy of the Altman Z-Score model and the Grover model in companies delisted on the IDX show that the Altman Z-Score model has the best accuracy rate of 71%. The explanation of the above research shows that the results are inconsistent because of the company sector under study and the sampling. Based on the research description above, the fourth hypothesis is adopted, H4: The Altman Z-Score model has the highest level of accuracy in predicting bankruptcy and sustainability.

### 3. Methodology

#### 3.1 Research Design

The present research employs a quantitative approach with secondary data from retail companies listed on the Indonesia Stock Exchange (IDX). The variables used in this study are models to predict bankruptcy and sustainability of the company with the Altman Z-Score model with a ratio of Working Capital to Total Assets (WCTA), Retained Earnings to Total Assets (RETA), Earning Before Interest and Tax to Total Assets (RETA) EBITDA), Book Value of Equity to Book Value of Total Liabilities (BVEBVTI), and Sales to Total Assets (SATA). Also, the Grover model with three ratios comprising working capital to total assets (WCTA), earnings before interest and taxes to total assets (EBITDA), and Return on Assets (ROA). The dependent variable is bankruptcy and sustainability that is measured using a dummy variable, where 0 means the company is in a healthy and ongoing condition (non-financial distress) and 1 means the company is experiencing bankruptcy (financial distress). The data analysis technique used by researchers is logistic regression analysis with SPSS version 24 software program. The present research utilises a purposive sampling method to determine the sample that follows specified criteria.

The following models are used:

$$Y = \beta_0 + \beta_1 \text{ZScore} + \beta_2 \text{GF}$$

Where:

Y: Bankruptcy (financial distress) (1) and ongoing (non-financial distress) (0)

$\beta_1$  ZScore: Altman Z-Score Model

$\beta_2$  GF: Grover Model

#### 3.2 Sample

The sample in this study is retail companies listed on the Indonesia Stock Exchange (IDX) from 2016-2018. A total of 19 observations that met the criteria through the Indonesia Stock Exchange ([www.idx.co.id](http://www.idx.co.id)) are involved. The minimum sample size is 30 therefore, the number of samples in this study meets the requirements. The final sample size is 57 observations from 19 companies, and it is determined using the purposive sampling method with the following criteria:

1. Retail companies listed on the Indonesia Stock Exchange in 2016-2018. Companies that go bankrupt (hereinafter, referred to as type 1) criteria are:
  - a. Companies that have negative net income
  - b. Companies that distribute dividends
2. Companies that published complete financial statements for 2016-2018.
3. The company that cut-off financial statements as of December 31
4. Retail companies are changing sectors and delisting.

**Table 1: Purpose Sampling**

No.	Criteria	Amount
1.	Retail companies listed on the Indonesia Stock Exchange in 2016-2018	25
2.	The company that published the complete financial statements for 2016-2018	25
3.	The company that cut-off financial statements as of December 31	25
4.	A Retail company that is changing sector	(6)
5	Total Samples	19
	Total number of samples during the study period (3 years)	57

### 3.3 Operational Definition and Measurements

#### 3.3.1 Bankruptcy

The definition of business failure varies from one study to another, depending on the purpose and scope of each research (Gu, 2002; Beaver, 1966; Dimitras et al., 1996; Altman, 1968). In some studies, business failure is defined as three consecutive years of negative net income (Youn and Gu, 2010; Pfeiffer, 2000; Cho, 1994). Economic failure, technical bankruptcy, and bankruptcy are terminologies that represent business failures (Altman, 1993; Tavlin et al., 1989). Prediction of bankruptcy (Financial Distress) and sustainability (Non-Financial Distress), with a value of 0 means the company is in a healthy and ongoing condition (non-financial distress), while 1 means the company is experiencing bankruptcy (financial distress).

#### 3.3.2 Altman Z Score model

Z-Score is a discriminant equation by calculating the value of the ratios used to predict the bankruptcy of a company (Hermanto and Agung, 2012: 241). Altman uses five financial ratios combined to predict whether a company is bankrupt or not. The Altman Z-Score analysis adopted Altman (1968) and was later developed in Altman (2000), Kolte, et. al (2017), and translated with the equation function as follows:

$$Z\text{-Score} = 0,717 X1 + 0.847 X2 + 3,107 X3 + 0,420 X4 + 0,998 X5$$

X1 = Working capital to total assets

$$\frac{\text{Current Assets} - \text{Current Liabilities}}{\text{Total Assets}}$$

X2 = Retained earnings to total assets

$$\frac{\text{Retained earnings}}{\text{Total Assets}}$$

X3 = Earnings before interest and tax to total assets

$$\frac{EBIT}{Total Assets}$$

X4 = Book value of equity to book value of total liabilities:

$$\frac{Book Value of Equity}{Book Value of Total Liabilities}$$

X5 = Sales to total assets:

$$\frac{Sales}{Total Assets}$$

### 3.3.3 Grover Model

The Grover model is a bankruptcy prediction model developed from the Altman model conducted by Jeffrey S. Grover in 1968 with 13 additional financial ratios and multiplying a sample of companies. This model uses the following equation.

$$Score = 1,650 X1 + 3,404 X2 - 0,016 ROA + 0,057$$

X1 = Working capital to total assets

$$\frac{Current Assets - Current Liabilities}{Total Assets}$$

X2 = Earnings before interest and tax to total assets

$$\frac{EBIT}{Total Assets}$$

ROA = Net income to total assets

$$\frac{Net Income}{Total Assets}$$

With the following criteria or cut-off: If  $G \leq -0.02$  score is estimated, the company will experience bankruptcy (financial distress), and if  $G \geq 0.01$  score is estimated the company is in good health and is still ongoing (non-financial distress), Grover (2001).

## 4. Discussion

### 4.1 Descriptive Statistical Analysis

Table 2 shows the Grover model score has a minimum value of -1.3866, a maximum value of 1.9556, a mean value of 0.646021, and a standard deviation value of 0.7332099. While the Altman Z-Score score model has a minimum value of -0.6130, a maximum value of 10.0903, a mean value of 3.314384, and a standard deviation of 1.7675773.



**Table 2: Descriptive Statistic**

	N	Min	Max	Sum	Mean		Std.Dev
	Statistic	Statistic	Statistic	Statistic	Statistic	Std.Error	Statistic
Grover	57	-1,3866	1,9556	36,8232	0,64602 1	0,097116 0	0,733209 9
Altman	57	-0,6130	10,0903	188,919 9	3,31438 4	0,234121 3	1,767577 3
Valid N	57						

Source: Results of data processing, 2020

## 4.2 Model Feasibility Test Results

The following is presented how the condition of each bankruptcy prediction model before and after the inclusion of bankruptcy prediction variables: Model Fit Altman *Z-Score Test*

**Table 3: Model Fit Altman Z-Score Test**

<b>Before</b>		
Iteration		-2 Log likelihood
Step 0	1	78,861
	2	78,861
<b>After</b>		
Iteration		-2 Log likelihood
Step 1	1	72,628
	2	72,423
	3	72,422
	4	72,422

Source: Results of data processing, 2020

In the table above, step 0 testing results in an initial log-likelihood value of 78.861. This value does not decrease significantly, so the model has not been able to explain the relationship between independent variables and related variables. The test that is carried out in step 1 produces a value of -2 log-likelihood of 72,628, where there is a decrease of -2 log-likelihood up to step 4 of 72,422. These results indicate that the Altman Z-Score model as a whole is fit that is considered capable of explaining the independent variables and their related variables.

### 4.3 Fit Grover Model Test Results

**Table 4: Fit Grover Model Test**

<b>Before</b>		
Iteration		-2 Log likelihood
Step 0	1	78,580
	2	78,580
<b>After</b>		
Iteration		-2 Log likelihood
Step 1	1	67,588
	2	67,144
	3	67,139
	4	67,139

Source: Results of data processing, 2020

In the table above, a step 0 test is conducted on the Grover model that produces an initial -2 log-likelihood value of 78,580. This value does not decrease significantly, so the model has not been able to explain the relationship between independent variables and related variables. The test in step 1 produces a value of -2 log-likelihood is 67.588, which shows that there is a decrease of -2 log-likelihood up to step 4 that is 67,139. These results indicate that the Grover model as a whole is fit that is considered capable of explaining the independent variables and their related variables.

### 4.4 Feasibility Test Regression Model

The followings are the results of the feasibility test of the Altman Z-Score regression model using the Hosmer and Lemeshow Test

**Table 5: Feasibility Test Altman Z-Score Regression Model**  
*Hosmer and Lemeshow Test*

Step	Chi-square	Df	Sig.
1	15,244	8	0,055

The table above shows that the significance of the Altman Z-Score model reaches  $0.055 > 0.05$ , thus it can be concluded that the Altman Z-Score model is feasible to use.

**Table 6: Feasibility Test of the Regression Model /**  
*Hosmer and Lemeshow Test*

Step	Chi-square	Df	Sig.
1	7,892	8	0,444

The table above shows that the significance of the Grover model reaches  $0.444 > 0.05$ , thus it can be concluded that the Grover model is feasible to use.

## 4.5 Hypothesis Testing

### 4.5.1 Logistic Regression Analysis Results

**Table 7: Altman Z-Score Model Regression Analysis Test**  
*Variables in the Equation*

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 <sup>a</sup>	Altman	-0,449	0,200	5,050	1	0,025	0,638	0,431	0,944
	Constant	1,345	0,687	3,836	1	0,050	3,840		

The results in the table above show that the significant value (step 1) for the Altman Z-Score model is 0.025 with a regression coefficient (B) of -0.449, so the value of sig.  $0.025 < 0.05$ , the smaller the Z-Score can predict high bankruptcy, which means that the H1 hypothesis is accepted, namely the Altman Z-Score model can be used to predict bankruptcy.

**Table 8: Grover Model Regression Analysis Test**  
*Variables in the Equation*

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 <sup>a</sup>	Grover	-1,493	0,525	8,105	1	0,004	0,225	0,080	0,628
	Constant	0,747	0,425	3,090	1	0,079	2,110		

The results in the table above show that the significant value (step 1) for the Grover model is 0.004 with a regression coefficient (B) of -1.493, so the value of sig.  $0.004 < 0.05$ , the smaller the Grover value can predict high bankruptcy, which means that the H2 hypothesis is accepted, that is the Grover model can be used to predict bankruptcy.

### 4.5.2 Paired Sample T-Test Comparison Test Results

The results of the table below show a probability of  $0,000 < 0.05$ , which means that there are significant mean differences between the two sample groups. From these results, it can be concluded that H3 is accepted, namely there is a difference in scores in predicting bankruptcy between the Altman Z-Score model and the Grover model with a confidence level of 95%.

**Table 9: Sample Paired T-Test**  
*Paired Samples Test*

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Dev	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Altman - Grover	2,668 3632	1,385 9724	0,183 5765	2,300615 2	3,036111 1	14,535	56	0,000

#### 4.5.3 Accuracy Test Results for Prediction Models

**Table 10: Accuracy and Error Type of Altman Z-Score and Grover Models**

Years	Altman Z-Score				Grover			
	Prediction Correct	Prediction False		Sample	Prediction Correct	Prediction False		Sample
		Type 1 Error	Type 2 Error			Type 1 Error	Type 2 Error	
2015	12	7	0	19	11	8	0	19
2016	11	8	0	19	11	8	0	19
2017	11	8	0	19	10	8	1	19
	34	23	0	57	32	24	1	57
Level of accuracy		60 %			56%			
Type 1 Error		40%			42%			
Type 2 Error		0%			2%			

##### 1) Altman Z-Score Model

The table above illustrates the overall calculation for 57 samples, consisting of 27 of type 1 (bankruptcy) and 30 (ongoing). From the prediction results of the Altman Z-Score model, it shows that 4 sample data are predicted correctly in bankruptcy conditions. The remaining 23 sample data are predicted incorrectly, namely in an ongoing condition that is categorised as Type 1 Error. Furthermore, 30 sample data are accurately predicted in the ongoing condition. There is no sample data that is predicted incorrectly, namely in a condition of bankruptcy, which is categorised as Type 2 Error. This finding shows the level of prediction error generated by the Altman Z-Score model. Based on the results of the calculation of the Altman Z-Score model, the accuracy rate is 60% at an error rate in each category consist of Type 1 Error of 40% and Type 2 Error of 0%.

##### 2) Grover Model

The table above illustrates the overall calculation for 57 samples, consisting of 27 samples of type 1 (bankruptcy) and 30 samples (ongoing). From the prediction

results of the Grover model, it shows that 3 sample data are predicted correctly in bankruptcy conditions. The remaining 24 sample data are predicted incorrectly, namely in an ongoing condition, which is categorised as Type 1 Error. Furthermore, 29 sample data are predicted correctly in the ongoing condition. The remaining 1 sample data is predicted incorrectly, namely in a condition of bankruptcy, which is categorized as Type 2 Error. This shows the level of prediction error that is generated by the Grover model. It can be concluded that based on the calculation results of the Grover model, the accuracy rate is 56% with an error rate in each category, namely Type 1 Error of 42% and Type 2 Error of 2%.

- 3) Accuracy Level Prediction Model Based on the table above, the highest accuracy prediction model begins with the Altman Z-Score model with an accuracy rate of 60%, then the Grover model with an accuracy rate of 56%. From these results, it can be concluded that H4 is accepted, that is, the Altman Z-Score Model has the highest level of accuracy in predicting bankruptcy and sustainability.

## 4.6 Discussion

### 4.6.1 Bankruptcy Prediction using the Altman Z-Score Model

Book Value of Equity to Book Value of Total Liabilities (BVEBVTL) is used to measure the ability of company to pay off its obligations from the Book value of equity. Sales to Total Assets (SATA) is used to measure a company's ability to use its assets or assets to generate sales. This is in line with the research of Triesie Avrilia Fanny and Endang Dwi Retnani (2017) that they are able to predict bankruptcy conditions. The Altman Z-Score model can well predict bankruptcy which shows that the financial ratios used in the model can describe bankruptcy conditions. The Altman Z-Score model uses five financial ratios comprising WCTA, RETA, EBITDA, BVEBVTL, and SATA. The five financial ratios demonstrate the financial position of a company, where its conditions are closely related to bankruptcy conditions. Working capital to total assets (WCTA) is a ratio that measures the liquidity of working capital position and total assets owned by a company implying that liquidity is closely related to bankruptcy.

The higher this ratio, the better the liquidity of a company. Retained earnings to total assets (RETA) measures the amount of profit (profit) that a company acquires during its operations. The longer the company operates, the greater the amount of its retained earnings. The earnings before interest and taxes to total assets (EBITDA) ratio measures the ability of a company to generate profits from the assets that are utilised, where the benefits do not include interest and taxes. This ratio does not involve interest and taxes so that the company can observe its profits from the operating activities. The higher this ratio, the less likely the company will be bankrupt. Book value of equity to book value of total liabilities (BVEBVTL) measures the ability of a company to pay off its obligations from the book value of equity. Sales to total assets (SATA) is used to measure the ability of a company to use its assets or assets to generate sales. The finding is in line with the research of Trieste Avrilia Fanny and Endang Dwi Retnani (2017) that they can predict bankruptcy conditions.

#### 4.6.2 Bankruptcy Prediction with the Altman Grover Model

The Grover model can predict bankruptcy in retail companies listed on the Indonesia Stock Exchange that shows the financial ratios used in the Grover model can describe bankruptcy conditions. Grover's model uses three financial ratios, comprising WCTA, EBITDA, and ROA. The three financial ratios demonstrate the financial position of a company in that it is closely related to bankruptcy conditions. Working capital to total assets (WCTA) measures the liquidity of working capital position and total assets owned by a company in that liquidity is closely related to bankruptcy. The higher this ratio, the better the liquidity of the company. The earnings before interest and taxes to total assets (EBITDA) measures the ability of a company to generate profits from the assets used in that the benefits do not include interest and tax. This ratio does not involve interest and tax for the company to observe its profits from the operating activities. The higher this ratio, the less likely the company will go bankrupt. The return on assets (ROA) ratio measures the ability of a company to generate sales or net profit from the total assets or assets owned by the company. The greater the ROA, the less likely the company is in a problematic condition. The finding is in line with the research of Barbara Gunawan et. al (2017) and Primasari (2017) on the Grover model being able to predict bankruptcy and sustainability conditions.

#### 4.6.3 The difference in Score between Altman Z-Score and Grover Model

To find the difference in scores in predicting bankruptcy between the Altman Z-Score model and the Grover model, there is a difference in scores between the Altman Z-Score model and the Grover model in predicting bankruptcy. This finding is in line with the research of Dimas Priambodo (2017) which shows that there are different scores in predicting financial distress between the Altman model and the Grover model.

#### 4.6.4 The Model with the Highest Level of Accuracy

To find out the highest level of accuracy in predicting bankruptcy and sustainability, the results show that the Altman Z-Score model has the highest level of accuracy than the Grover model. This finding is in line with the research of Hantono (2019) and Reza Prabowo (2015) which shows that the Altman Z-Score model has the best / highest accuracy level.

### 5. Conclusion

This study aims to prove whether the Altman Z-Score and Grover models can predict bankruptcy and sustainability and identify whether there are differences in bankruptcy and sustainability prediction scores with the Altman Z-Score and Grover models, and to find out which models are the most accurate in predicting bankruptcy and sustainability in retailing companies listed on the Indonesia Stock Exchange (IDX). The results show that the Altman Z-Score model with Grover can predict bankruptcy and sustainability conditions and there are differences in scores between the Altman Z-Score and Grover models in predicting bankruptcy Besides, due to its accuracy, the

Altman Z-Score model is the most suitable bankruptcy prediction model that is applied to retail companies listed on the Indonesia Stock Exchange.

This research implies that the results of this study can be used as a reference by managers and investors to find out the correct bankruptcy prediction models so that they can make better decisions. The Altman Z-Score model can be used to predict bankruptcy in retail companies, which currently tend to be sluggish so that companies must continue to innovate in terms of trading. This shows that the financial ratios used in the Altman Z-Score model can describe bankruptcy conditions. The Altman Z-Score model uses five financial ratios, consists of WCTA, RETA, EBITDA, BVEBVTL, and SATA. The five financial ratios describe the financial conditions of a company, in that they are closely related to bankruptcy conditions. The Altman Z-Score model is the most suitable bankruptcy prediction model that is applied to retail companies listed on the IDX. Based on the results of the prediction model accuracy test, the Altman Z-Score has the highest level of accuracy compared to the Grover model. Besides, for creditors concerning the results of this study, it can be used as a basis for providing credit to companies that are indicated to be experiencing bankruptcy (financial distress). The research findings may also have implications regarding the development of a theory of bankruptcy prediction in a specific sector of the economy in crisis because the retail sector is currently in a sluggish state with the presence of e-commerce and online companies.

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